

Remarks

Claims 9 - 16 and 18 - 22 are pending. Favorable reconsideration is respectfully requested.

Applicants wish to thank Examiner Nwaonicha for pointing out the rather obvious error in the structure of the alkene of formula (III). The formula has been corrected in the claim as well as in the Specification on page 2. Withdrawal of the rejection of claim 9 under 35 U.S.C. § 112¶2 is respectfully solicited.

Claims 9 - 22 have been rejected for non-statutory obviousness-type double patenting over commonly assigned U.S. Patent 6,388,119. Accompanying this response is a terminal disclaimer disclaiming the terminal portion of any patent granted from this application which would extend beyond the full unshortened statutory term of U.S. 6,388,119. Withdrawal of the non-statutory obviousness rejection is solicited.

Claims 9 - 22 have been rejected under 35 U.S.C. § 103(a) over Tonomura U.S. Patent 6,359,161 ("*Tonomura*"). In view of Applicants' amendment to claim 1, Applicants respectfully traverse this rejection. Support for the amendment may be found on page 4, lines 1 - 5 and page 5, lines 17 - 20, hence no new matter is implicated.

Applicants' claimed invention is directed to a continuous process for preparing organosilanes by hydrosilylation of an alkene with an Si-H-functional silane, in the presence of an iridium diene complex hydrosilylation catalyst and in the presence of excess diene as a catalyst stabilizer, where the alkene is always maintained in excess while the hydrosilylation catalyst is present, by employing more than the stoichiometric amount of alkene. Dependent claims pertain to the separation of product from reactor effluent and recycling of the high boiling residue to the reactor for re-use and hydrosilylation catalyst.

Preparation of organosilanes by hydrosilylation of an alkene by an Si-H-functional silane is known. However, Pt-containing catalysts are generally used, and yields are poor. Iridium catalysts have also been used, again with poor results. Even when excess diene is employed with iridium catalysts as taught by EP-A-1156052 (described in the specification on page 1), yields are still poor. The latter reference is the equivalent of Tonomura U.S. Patent 6,359,161 ("*Tonomura*"). Even with a 4-fold molar excess of diene, the maximum yield reported is but 92.7%, with Example 3 reporting a yield of 73.9%. It must be remembered that the silanes employed in the process are expensive reactants, and that the product also commands a high price. Thus, yield (and purity) is much more important than in processes employing commodity reactants or products.

The process disclosed by *Tonomura* is not a commercially attractive reaction, not only due to the relatively low yield, but also due to engineering and safety issues as described in the last paragraph of page 1. The *Tonomura* process is a batch processes, and hydrosilylation is extremely exothermic. At times, the reaction may become "dormant" during addition of one of the two reactants to the reactor due to poisoning of the catalyst, resulting in a high concentration of unreacted reactants. If the catalyst revives from its dormant state, the resulting exotherm can have catastrophic consequences. The addition of excess diene helps stabilize the catalyst against poisoning. However, this is not enough to guarantee avoiding the scenario presented above.

Applicants have discovered that if an excess of alkene of the formula (III) is always present over the concentration of silane (II), poisoning of the catalyst will not occur, and the risks otherwise associated with the reaction are eliminated. Strict stoichiometric control (i.e. a 1.00:1.00 mol ratio of reactants) is virtually impossible, since local inhomogeneities caused by inadequate or variable agitation, reactant flow rates, etc., can occur, which will result in local catalyst poisoning.

Tonomura does not teach or suggest a continuous operation, and never recognized that the low yield and variability associated with his process was most likely caused by poisoning of the catalyst by silane, as shown by his examples. All of *Tonomura*'s examples are done at a 1.0:1.0 ratio (exactly stoichiometric) of alkene to silane. Under these conditions, the increased concentration of silane which occurs, for example, at the point of entry of silane into the reactor, will cause gradual catalyst deactivation.

By employing a continuous reaction instead of a batch reaction, and by employing a slight excess of alkene, Applicants are able to increase the yield to very high values, 95% in each example, while obtaining very high product purity (>99%) at the same time. It is believed that the increased yield is due to the fact that the slight excess of alkene serves to prevent excursions in stoichiometry which would otherwise poison the catalyst.

A comparison to *Tonomura* may be useful here. In Example 1 of the subject invention, the same catalyst and reactants were used as in Example 1 of *Tonomura*, with the exception that the ratio of diene stabilizer to catalyst in *Tonomura*, Example 1 is 4:1, whereas in Applicants' Example 1 it is closer to (somewhat below) 3:1. Applicants reaction temperature is 80°C as opposed to 35°C for *Tonomura*. Applicants higher temperature would ordinarily be expected to increase space/time yield but lower the (yield) and purity, while Applicants lower stabilizer/catalyst ratio would be expected to lower the total yield or space/time yield. However, Applicants yield was 95% as compared to a yield of 92.7% of *Tonomura*. *Tonomura* does not report product purity. It is also noted that Applicants' Example 2 was virtually identical to example 1, but was conducted at 50°C, much closer to *Tonomura*'s 35°C. No change in product yield or purity over Applicant's Example 1 was observed.

Example 7 of the present application is similar to *Tonomura*'s Example 3, but operated at a temperature of 80°C. Applicants' yield was 95%, as compared to *Tonomura*'s yield of 73.9%.

The inventor has performed two additional examples in Applicants' Assignee's laboratories in Burghausen, Germany. In these two comparative examples, an excess of silane was employed. No product was obtained in either case. The two comparative Examples are as follows:

Example 11 (comparative, not according to the invention)

Example 1 was repeated with the modification that a mixture of $2,7 \times 10^{-3}$ mol-% di- μ -chloro-bis-[(cycloocta-1c,5c-diene)-iridium(1)], 7×10^{-1} mol-% 1,5-cyclooctadiene in dimethylchlorosilane, and allyl chloride in a molar ratio of silane: allyl chloride of 1.3 : 1 were fed to the reaction. No product was found.


Example 12 (comparative, not according to the invention)

Example 1 was repeated with the modification that the reactants were fed to the reactor in a molar ratio of silane : allyl chloride of 1 : 0.8. No product was found.

The examples can be presented in the form of a Declaration if the Examiner wishes. Withdrawal of the rejection over *Tonomura* is solicited.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, the Examiner is highly encouraged to telephone Applicants' attorney at the number given below.

Respectfully submitted,
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